WE CLAIM:

1. A compliant apparatus comprising:

a tubular structure formed from a tube made of a material having a reversible structural behavior, and

at least one compliant mechanism also formed from the tube as part of the tubular structure; wherein

the compliant apparatus has no mechanical joints; and wherein

the compliant apparatus is capable of being controlled to maneuver reversibly in various motions and degree-of-freedoms without permanent deformation.

2. The compliant apparatus of claim 1, wherein the cross-section of the tube is characterized as circular, oval, rectangular, square, straight, curvy, angular, or irregular.

3. The compliant apparatus of claim 1, wherein the reversible structural behavior is characterized as elastic or superelastic.

4. The compliant apparatus of claim 1, wherein the material is selected from the group consisting of an elastic alloy including stainless steel and titanium alloy, and a superelastic alloy including nitinol, Cu-Al-Ni, Cu-Al, Cu-Zn-Al, Ti-V and Ti-Nb alloy.

5. The compliant apparatus of claim 1, wherein the compliant mechanism stores strain energy and utilizes the stored energy as a bias force for shape recovery.

6. The compliant apparatus of claim 1, wherein the compliant mechanism is capable of being actuated by at least one actuators.

7. The compliant apparatus of claim 6, wherein the at least one actuators are made of Shape Memory Alloys (SMAs) and wherein the SMAs are based on shape memory effects including contraction, rotation, and a combination thereof.

8. The compliant apparatus of claim 7, wherein the SMAs are configured for manipulating the compliant apparatus and the compliant mechanism.

9. The compliant apparatus of claim 6, wherein the at least one actuators are characterized as piezoelectric or electro-active polymer actuators.

10. The compliant apparatus of claim 6, wherein the at least one actuators are characterized as wires connected to an external apparatus and actuated remotely via the external apparatus.

11. The compliant apparatus of claim 6, wherein the at least one actuators are characterized as Shape Memory Alloy wires or Shape Memory Alloy springs.

12. A method of fabricating the compliant apparatus of claim 1, comprising:

forming the compliant mechanism and the tubular structure out of a tube with laser machining.

13. The method of claim 12, wherein

the laser machining having a laser beam size of about 50 μm or less.

14. The compliant apparatus of claim 1, further comprising at least one built-in micro structure selected from the group consisting of a welding-enabling structure and a clamping-enabling structure.

15. A method of joining the compliant apparatus of claim 14 with at least one actuators, comprising the step of:

attaching the at least one actuators to the compliant apparatus via the at least one built-in micro structure.

16. The method of claim 15, wherein the at least one built-in micro structure is the welding-enabling structure, the method further comprising the step of:

welding the at least one actuators to the welding-enabling structure using a laser.

17. The method of claim 16, wherein

the laser having a laser beam size of about 200 μm or less.

18. An ultrasonic imaging system useful for intravascular ultrasound forward imaging applications, the ultrasonic imaging system comprising:

a compliant apparatus having no mechanical joints and capable of being manipulated in various motions and degree-of-freedoms without permanent deformation, the compliant apparatus comprising:

a tubular structure formed from a tube made of a material having a reversible structural behavior; and

at least one compliant mechanism integrally formed from the tube;

an ultrasound transducer coupled to the compliant apparatus; and

at least one actuators attached to the compliant apparatus for manipulating the compliant apparatus and the at least one compliant mechanism.

19. The ultrasonic imaging system of claim 18, wherein the reversible structural behavior is characterized as elastic or superelastic.

20. The ultrasonic imaging system of claim 18, wherein the material is selected from the group consisting of an elastic alloy including stainless steel and titanium alloy, and a superelastic alloy including nitinol, Cu-Al-Ni, Cu-Al, Cu-Zn-Al, Ti-V and Ti-Nb alloy.

21. The ultrasonic imaging system of claim 18, wherein the at least one actuators are made of Shape Memory Alloys (SMAs) and wherein the SMAs are based on shape memory effects including contraction, rotation, and a combination thereof to maximize output displacement of the at least one compliant mechanism.

22. The ultrasonic imaging system of claim 18, wherein the at least one actuators are characterized as piezoelectric or electro-active polymer actuators.

23. The ultrasonic imaging system of claim 18, wherein the at least one actuators are characterized as wires connected to an external apparatus and actuated remotely via the external apparatus.

24. The ultrasonic imaging system of claim 18, further comprising:

two additional actuators configured to actuate the compliant apparatus in an orthogonal direction, enabling the compliant apparatus to provide the ultrasound transducer with full three dimensional scanning motions.

25. The ultrasonic imaging system of claim 24, wherein the at least one actuators and the two additional actuators are characterized as SMA wires or SMA springs.

26. A micromanipulator useful for intravascular applications including imaging and therapy, the micromanipulator comprising:

a tubular elastic or superelastic element having no mechanical joints and formed from a tube made of a material having a reversible structural behavior; and

at least one actuators for manipulating the tubular elastic or superelastic element.

27. The micromanipulator of claim 26, wherein the at least one actuators are selected from the group consisting of Shape Memory Alloy (SMA) actuators, piezoelectric actuators, and electro-active polymer actuators.

28. The micromanipulator of claim 27, wherein the at least one actuators are characterized as wires connected to an external apparatus and actuated remotely via the external apparatus.

29. A system useful for intravascular applications including imaging and therapy, the system comprising:

a micromanipulator having no mechanical joints and characterized as a tubular structure made of an elastic or superelastic material; and

a plurality of compliant mechanisms forming an integral part of the micromanipulator, having various configurations, and positioned in various locations of the micromanipulator for enabling intricate motions of the micromanipulator; and

at least one actuators coupled to the plurality of compliant mechanisms for effecting the intricate motions of the micromanipulator.

30. The system of claim 29, wherein the at least one actuators are selected from the group consisting of Shape Memory Alloy (SMA) actuators, piezoelectric actuators, and electro-active polymer actuators.

31. The system of claim 29, wherein the at least one actuators are characterized as wires connected to an external apparatus and actuated remotely via the external apparatus.

32. The system of claim 29, further comprising:

two additional actuators configured to actuate the compliant apparatus in an orthogonal direction, enabling the micromanipulator with full three dimensional steering motions.

33. The system of claim 29, wherein the at least one actuators and the two additional actuators are characterized as SMA wires or SMA springs.

34. The system of claim 29, wherein

each compliant mechanism is individually controllable via the at least one actuators.

35. The system of claim 29, wherein

the at least one actuators are controlled by a remote electronic circuitry via a user interface.

36. The system of claim 29, wherein

the micromanipulator and the plurality of compliant mechanisms are assembled together subsequent to being respectively formed.

37. The system of claim 29, further comprising:

an ultrasound transducer coupled to the micromanipulator.

38. The system of claim 29, further comprising:

a cooling system coupled to the micromanipulator for regulating temperature thereof.

39. The system of claim 38, wherein

the cooling system comprises a pumping means and biocompatible cooling fluid; and wherein

the pumping means provides a constant flow of the cooling fluid to the micromanipulator to prevent the at least one actuators from overheating.